The last question you require to be answered is, "Can I give any elucidation as to the difference?" &c. This borders on a physical question, and on that point I regret to have caused some displeasure to Sir John Herschel, by quoting a passage in the fifth edition of his *Outlines*, p. 639, sec. 871.

The object is now getting below the Pole, and daylight fast increasing; but when a favourable opportunity occurs, I will not omit to pay every possible attention to the requirements contained in your letter, feeling convinced, notwithstanding the contrary opinion, that the fluctuations which have taken place in *Argus* will some day become better known.

With regard to the fluctuations, distance and position very materially affect visible motion, and the changes about η are physical, if any, and therefore it would be necessary to adopt a real standard instrument, such as the old 18-inch erected at the Cape of Good Hope in its former position.

P.S.—I cannot refrain from mentioning my surprise at seeing an extract from a letter to the Astronomer Royal from Mr. H. A. Severn, of Melbourne, in the *Monthly Notices*, vol. xxx. p. 180. It is utterly at variance with the author's letters addressed to me, in all of which he not only acknowledges the changes in *Argus*, but also appears anxious that I should be credited with the discovery.

Surely there must be some mistake in the extract from the *Notices*. I have this moment received another letter from Mr. Severn, in which he expresses the same opinion on the fluctuations as before.

Private Observatory, Hobart Town,
Tasmania, 7th September, 1870.

There has since been received from him the following further communication:—

On η Argûs and its Surrounding Nebula. By F. Abbott, Esq.

To the Honorary Secretaries and Referees appointed by the Council of the Royal Astronomical Society to make inquiry as to certain alterations which have taken place in the star η *Argûs* and its surrounding Nebula.

In carefully looking over the drawings referred to, which were taken at Bangalore by Lieut. Herschel, with the object η *Argûs* 15° above the horizon, and also the *reversed* copy of Sir J. Herschel's, and on consideration of the discussion given with the drawings, I do not think that Lieut. Herschel's observations tend to disprove any one of the alterations which I have previously communicated to the Society, but, on the contrary, rather to confirm them. This, I think, will appear clear by an inspection of

the present drawing* and the answers given to questions put by the referees.

The present drawing is taken with the same instrument as the former ones, the object in the same position approximately 80° above the horizon. The measures have been made with a *bar micrometer* by Cook and Sons, the bars being carefully traced in pencil on the drawing paper in such a way as to exactly fill the field of the telescope. All the stars visible were then dotted down, the distances from η of the sixth, seventh, and eighth magnitude stars were lettered, measured, and catalogued from a scale of equal parts; after which the micrometer pencil lines were rubbed out, and the Nebula inserted.

The first question put by the referees relates to a comparison of the positions of the principal stars and smaller groups, as shown in my two drawings, which are said to have a sufficient general agreement with each other, considered as eye-drafts, while they are irreconcilable with both Sir John and Lieut. Herschel's configurations. A simple inspection of my drawing of 1870, with the reversed drawing (A A), plate 4, of Sir J. Herschel, in the *Monthly Notices*, will show that the following principal stars hold a relative position, considered as eye-drafts, but not with the Cape monograph, as expressed in the letter D′, D—C′, C—(ν), :κ—B—ζ—(ε)—522—558—640—337—383—415—(γ)—(λ), &c. &c. There are many other stars in my copy of 1870 that are not laid down in plate 4, pricked off from Lieut. Herschel's drawing.

The other question of note refers to my "having placed within $11\frac{1}{2}'$ (on the scale of my drawing of η) five stars of magnitude at least equal to η, that is the 7th mag., while in Sir J. Herschel's monograph only one star of that magnitude (marked C) occurs within that distance, and five of the eighth mag.," and continues, "Can you give any elucidation of the cause of the discrepancy? also, if you would furnish some instrumental determination of the difference of R.A. and P.D. between η and other stars of equal magnitude."

In my acknowledgment of this letter to Mr. Wm. Huggins,

* Plate of η *Argûs*, as taken February 1871.—Ed. The drawing has upon it a reference to the several stars, as follows:—

	Mag.	Dist. from η.		Mag.	Dist. from η.		Mag.	Dist. from η.
		′ ″			′ ″			′ ″
α	5	29 30	ι	7½	15 45	ϱ	8½	30 20
β	6	26 0	κ	7½	16 10	σ	8½	29 15
γ	6½	32 0	λ	7½	17 30	τ	8½	29 40
δ	6½	26 30	μ	8	21 25	υ	8½	8 20
ε	7	22 30	ν	8	25 50	φ	8	12 0
ζ	7	31 20	ξ	8	40 0	χ	8½	26 40
η	7	—	ο	8	25 30	ψ	8½	13 50
θ	7½	16 15	π	8½	32 25	ω	8½	6 0

F.R.S., &c., I mentioned that it was not my intention or desire to dispute either Sir John's or Lieut. Herschel's configurations, but to call the attention of the astronomical world to the altered features of both the star and the nebula, with a view of obtaining a solution of the changes seen in this most remarkable object. I further stated that the above question was of a physical nature, and could only be answered as such.

On reference to my former papers it will be seen that mention is made, more than once, of the fact that the increase of stars of the same magnitude as η renders it difficult to know that star from others only by its position and a marked difference in the *light*. The present drawing will show a still greater and more remarkable number of stars of a similar magnitude.

It is to this cause I have so frequently referred, the increase of light, which I think is now clearly confirmed by both Sir John and Lieut. Herschel. At one of the monthly meetings of the Society Sir John considered the increased light in the object, as recorded, very strange, and remarked, "When I was at the Cape the Nebula could not be seen at all with the naked eye." Lieut. Herschel, at Bangalore, compared the light when the object was 15° above the horizon to *Pleiades* in *Taurus*.

Mr. Le Sueur, in his report on the Melbourne Reflector, says, "that the Nebula around η *Argûs* has changed largely in shape since Sir J. Herschel was at the Cape. The star shines with the light of burning hydrogen," and in his opinion "has consumed the Nebula."

The Catalogue will show that there are now in the same field two stars of the 6th, two $6\frac{1}{2}$, three 7th, four $7\frac{1}{2}$, four 8th, and nine of the $8\frac{1}{2}$ magnitude, and it is literally crowded with others of from the $8\frac{1}{2}$ to the 12th magnitude. Those lying outside the field and occupying an area of about $1\frac{1}{2}°$ have their magnitudes attached. The small cluster I take to be Sir J. Herschel's 3276, described as a "fine, bright, rich, not very large cluster;" if so, it is now a beautiful cluster of richly coloured stars, quite equal to χ *Crucis*.

It is almost impossible to define the boundary of the Nebula as it appears to be gradually fading away, and is not so distinct in outline as formerly.

The finest nights have always been selected for observing, and no delineation of the object has ever been given but what was an accurate representation of its appearance through the telescope.

Private Observatory, Hobart Town,
Tasmania, 17th February, 1871.

The foregoing Papers were referred to Mr. Airy, who remarks upon them as follows:—

I duly received the packet of papers relating to Mr. Abbott's observations on η *Argûs;* and with these I have perused

also the preceding papers in various volumes of the *Monthly Notices*. The subject is really a very puzzling one.

1. As regards stars only, the map of 1870 and the map of 1871* have so much difference (not a great deal) that I conceive them to be certainly independent; and yet they have so much similarity as to give strong probability to their faithful representation of the visible objects. See in particular the line of four stars convex towards *η Argûs*.

2. These four stars have some agreement, not quite good, with four of Sir J. Herschel's. But other stars in the concavity of the bend are wanting in Sir J. Herschel's.

3. When we look more closely to fundamental points, all is confusion. Mr. Abbott's observations were all made with a refracting telescope: in that case the order of the four cardinal directions on the map would be E $\overset{N}{S}$ W (turned round, in any degree). But in the 1870 map he has marked them W $\overset{N}{S}$ E: in the 1871 map he has marked only $\overset{N}{S}$. The $\overset{N}{S}$ in the two maps differ about 45°.

4. In each of these maps is a line (different for the two) which he calls "Line of Sight." What this means I have not the slightest idea.

5. In points of geometry, therefore, Mr. Abbott is a most inaccurate man.

6. It is impossible for us to publish maps in this state.

7. As regards the delineation of the nebula, I cannot make out anything. The drawing in the second map, dated February 1871, agrees EXACTLY with Lieut. Herschel's drawing, 1868, Nov. 23, published in the *Monthly Notices*, 1869, Jan. 8 [misprinted 1868 in the *Monthly Notice*]. This drawing (Lieut. Herschel's) had undoubtedly reached Australia. Has Mr. Abbott copied it? Mr. Abbott's first map, dated 1870, Jan. 28, is irreconcilable with Lieut. Herschel's, which preceded, or with his own which followed.

8. While, therefore, I do concede to Mr. Abbott the merit of first pointing out that the nebula has shifted its position with regard to the star *η Argûs*, and has changed its form materially (both which points I regard as certain), I feel most strongly that his maps are utterly unfit for publication.

Allow me to suggest that papers of this kind ought to be preserved more carefully. Mr. Abbott's maps were crimped up till I could not read them. I have flattened them, and will endeavour to persuade Mr. Dunkin to keep them flat.

Royal Observatory, Greenwich,
1871, *May* 25.

* See the two Plates of *η Argûs*.—ED.